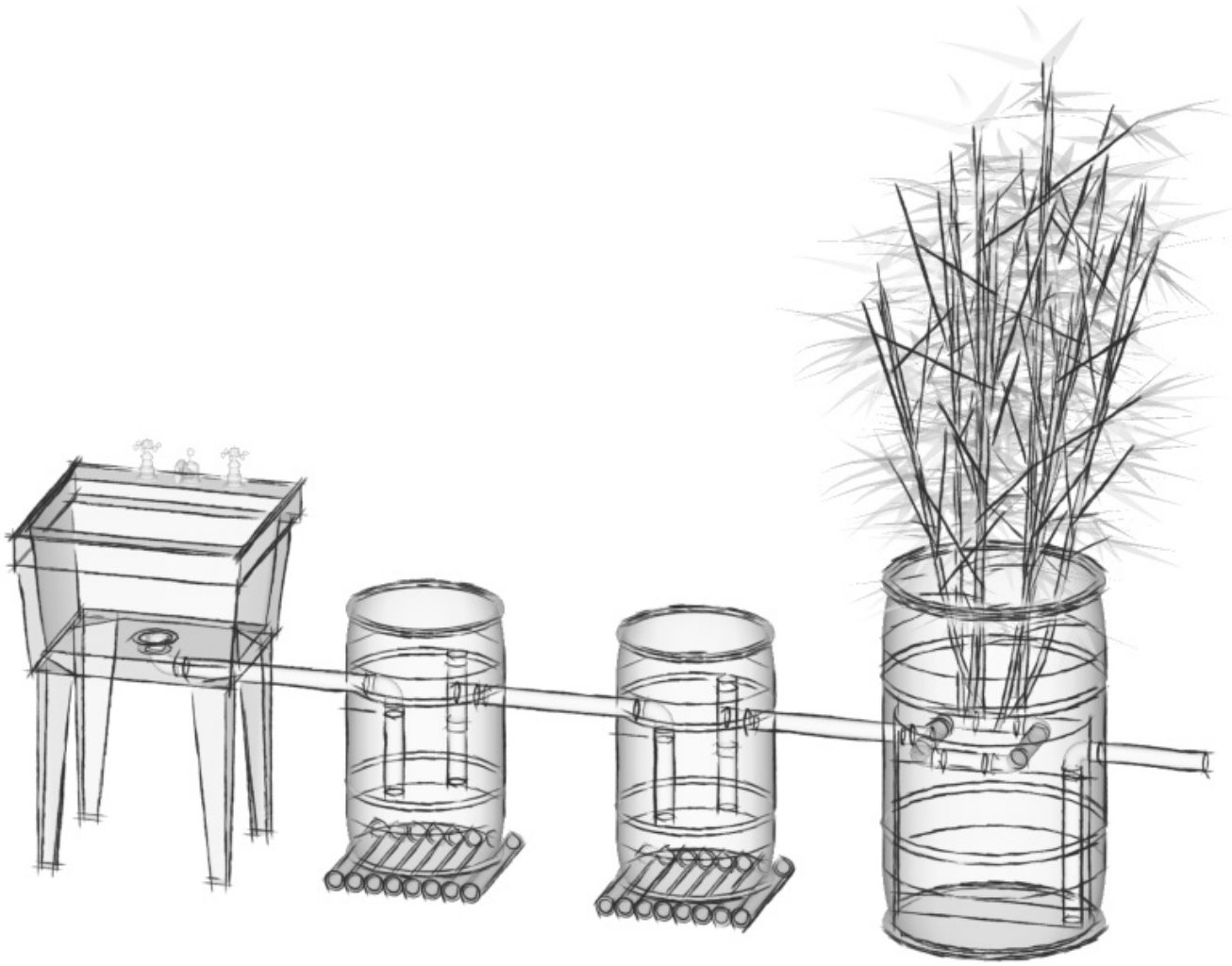


HOME WATER TREATMENT SYSTEM

guide for construction and use

THAILAB

METABOLIC
FOUNDATION

Version 1, June 2014, produced by Thailab and Metabolic Foundation

Contents

3 Introduction

4 System overview

5 Tools needed

6 Materials

9 Construction guide
- 11 settling tanks
- 15 biofilter
- 23 storage tank

25 User manual
- 25 initial use
- 25 cleaning and maintenance
- 26 monitoring

27 Datasheet

28 Contact information

Introduction

What is a greywater treatment system?

A greywater treatment system is an installation which improves household water, which was used for uses other than the toilet, such as laundry, dish-washing, cleaning, or showering. The treated water is then safe to discharge into the environment, or to be re-used for non-drinking uses such as cleaning, laundry, irrigation, or dish washing.

Why treat greywater?

In many households, greywater is not treated and is discharged directly into nearby water bodies or into the ground. Untreated greywater can have negative impacts on environmental surface water because of high levels of nutrients, which increase processes of eutrophication in water, and because of food waste, bacteria and oil which can cause unpleasant smells. Soaps and detergents can also carry other chemicals that are harmful to water-based fish and plants.

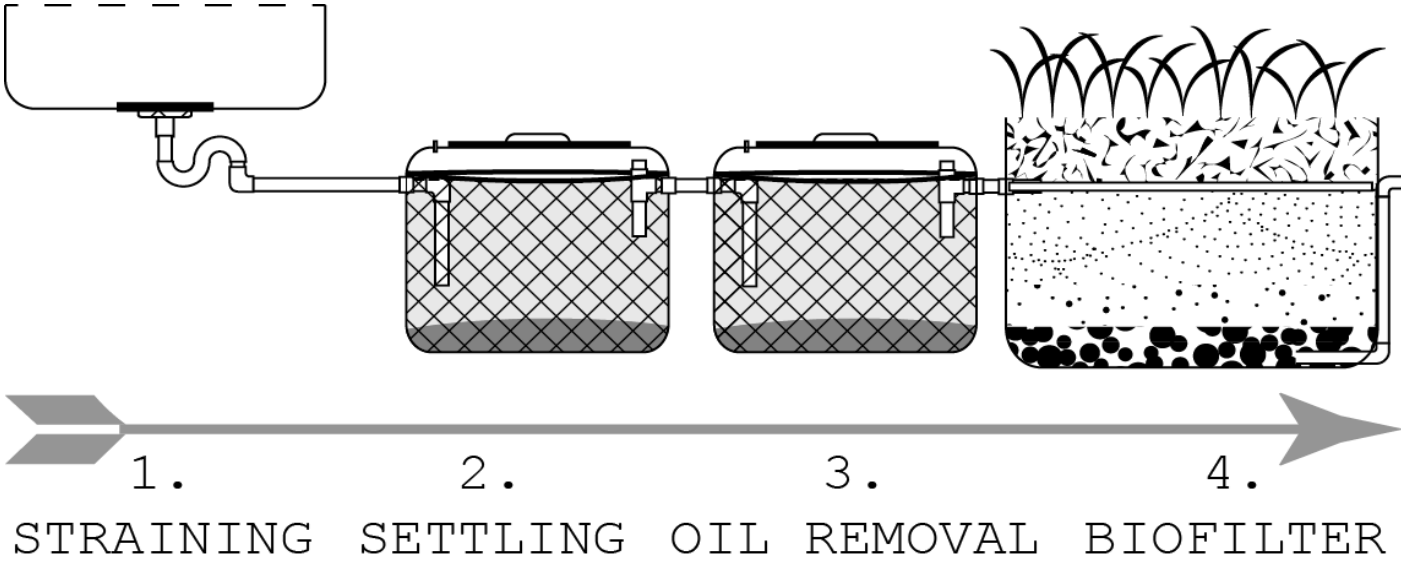
Water is also becoming a scarce resource in many places, especially cities, where watersheds are overburdened and under served. Recycling water improves, the sustainability of the city by decreasing water extraction and when combined with urban agriculture increasing water recharge and decreasing peak flows. All while saving households money.

What can treated water be used for?

Water can be used for watering plants and cleaning as well as laundry and dishwashing. Treated water can also be simply discharged into the nearby water bodies as before, but with decreased nutrients and fewer negative environmental effects.

Note: water from this system should not be used for drinking without further treatment sufficient to meet drinking water quality standards.

System overview



The system consists of three main components. The first is a simple screen placed in the sink, to remove large pieces of food (1.). The second involves holding the wastewater in a tank for a period of time to allow for solids to settle to the bottom (2.) and oil and grease to float to the top (3.).

The water then moves into the third component, the biofilter, which uses plants and good bacteria to remove nutrients, harmful bacteria, and other chemicals from the water (4.). After this the water can be can be safely discharged or stored and re-used for other purposes as needed.

Tools needed

1 power drill

2 drill bits
3mm, 8mm, and 40mm diameter

3 small saw or hacksaw

4 coarse sandpaper

5 rounded file

6 tape measure

7 utility knife

8 pencil or marker

9 rubber gloves

10 small buckets
4-5 liters

11 large buckets
20-30 liters

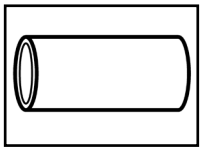
12 dust mask

13 friends

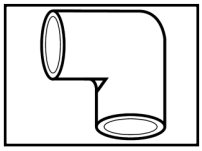
14 *sand sifter (optional)*
for separating large rocks

Materials

PVC pipes and connections (all 40mm or 1½" size)

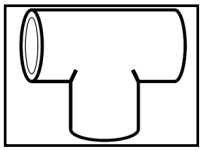


4m of straight pipe



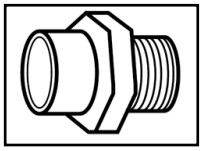
elbow connections

1 for each settling tank
1 for each storage tank
5 for each biofilter
2 for overflow drainage



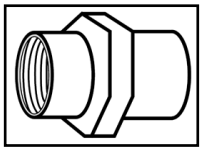
T-shaped connections

1 for each settling tank
1 for each biofilter



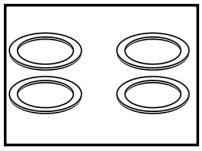
Inner threaded connections

2 per tank/biofilter



outer threaded connections

2 per tank/biofilter



gaskets

4 per tank/biofilter

flexible pipe, adapter and/or funnel to connect to sink, as required

Plumbing supplies

PVC pipe glue

PTFE/teflon tape

Materials

Tanks

50L barrels

1 for each settling tank
with removable lids

200L barrel

1 for each biofilter
with open top

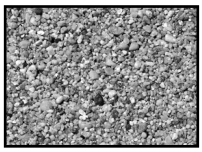
150 L barrel

1 for each storage tank

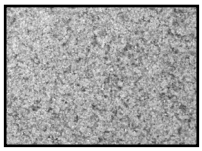
Alternative materials can also be used, such as cement tanks. Make sure the material will not leach into the water. The biofilter needs at least 60cm of height to function properly.

Additional biofilter materials

8-10 vetiver grass plants (*Chrysopogon zizanioides*)



about 4 bags of coarse sand



about ½ bag of fine sand

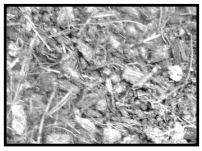
3-5 bags of (activated) charcoal pieces

about 1 bag of coarse gravel

Materials

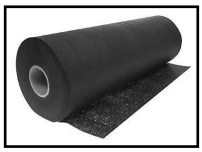
Additional biofilter materials

3-5 bags of coconut fiber

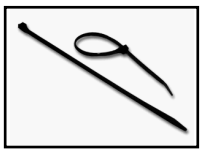


about 3 bags of chopped coconut fiber

Other

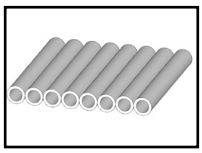


2m^2 plastic fabric mesh



cable ties or plastic string

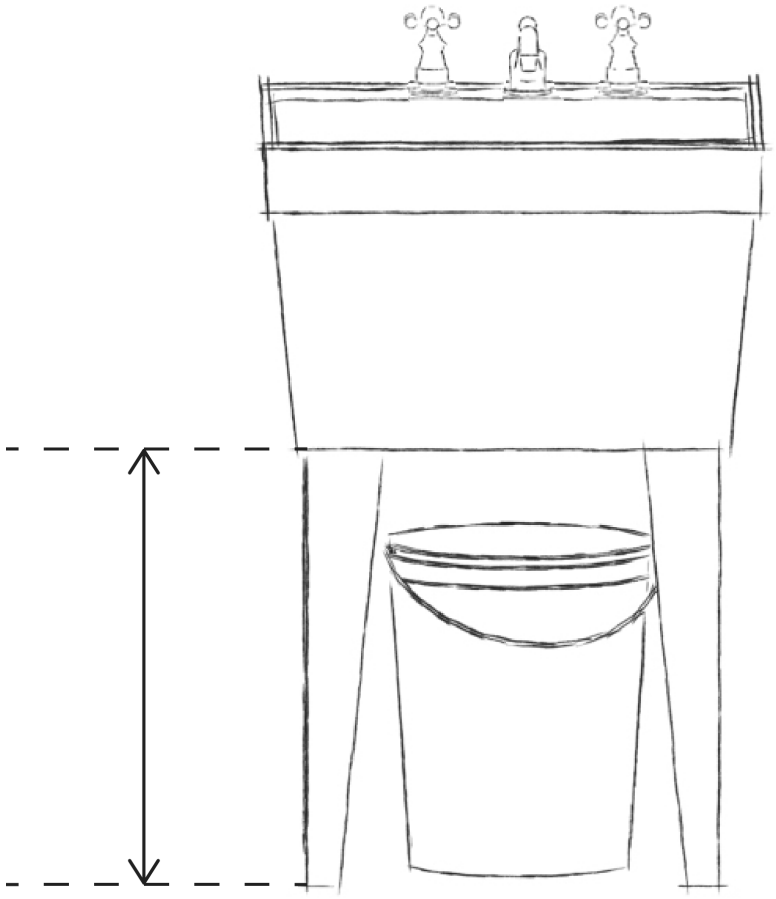
2m flexible plastic tubing (tylene)



support structure materials

price varies depending on material, e.g. low-cost wooden pallet, bamboo and wire, or free scrap materials

Initial measurements



Step 1

I. Measure the distance between the sink drain and the ground below it.

II. If there is no sink, measure the highest comfortable height to pour wastewater into the treatment system by hand.

III. Check if the ground is level. If it is not level, either prepare it to be level, or make sure you account for the slope as you construct your water system. Remember that water needs to flow downhill.

IV. If the available space is less than 40cm, try to raise the sink up higher, or add a pump to bring the water up from the sink drain to the treatment system. Alternatively, a hole can be dug to hold to lower the water treatment system to below ground-level.

Step 2

I. Measure the flow of wastewater that you will treat by placing a large bucket under the sink to collect it.

II. Empty the bucket each time it fills, and count how many times it fills during the day.

III. If it is only partly full at the end of the day, estimate how full it is and write down the total number of buckets of wastewater collected during the day.

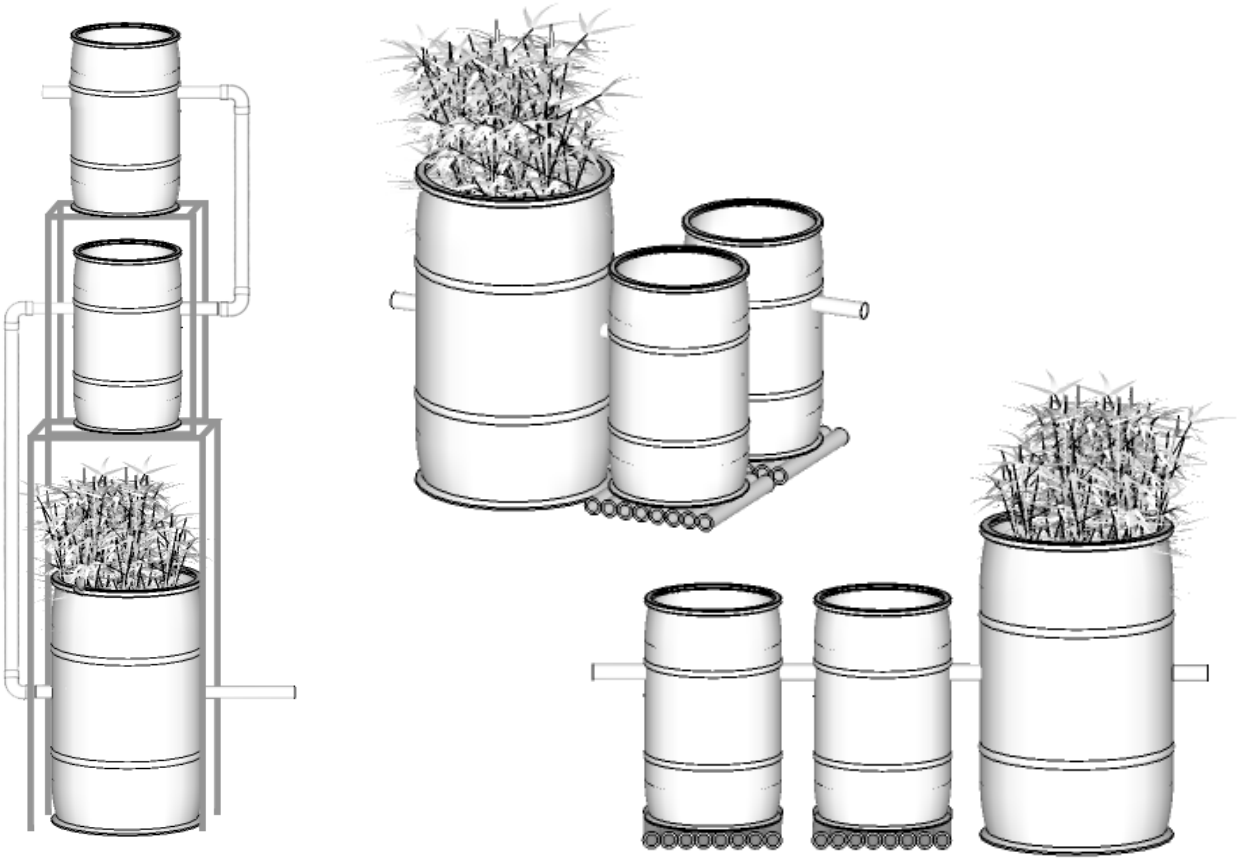
IV. Multiply the number of buckets by the volume of the bucket.

V. Do this for at least 3 days and calculate the average.

VI. This will be used to decide how large your system should be.

VII. *If the volume of the bucket is not known, use a water bottle to pour water into the bucket until it is full. Count how many bottles it takes, and multiply this by the volume of the water bottle to get the volume of the bucket.*

Initial measurements



Step 3

I. Measure the area where you want to put the water treatment system. It will need to be 2.5-3m in length and 55cm wide. If the area is smaller, or differently shaped, you will need to arrange your tanks differently

II. Calculate what size your system should be.

- Your system should be able to hold a day of water in the settling tanks.
- Use the volume of water per day that you measured in Step 2 to determine how big your settling tanks should be, or how many.
- For example, if you use 100L of water in a day, you can use two 50L settling tanks.

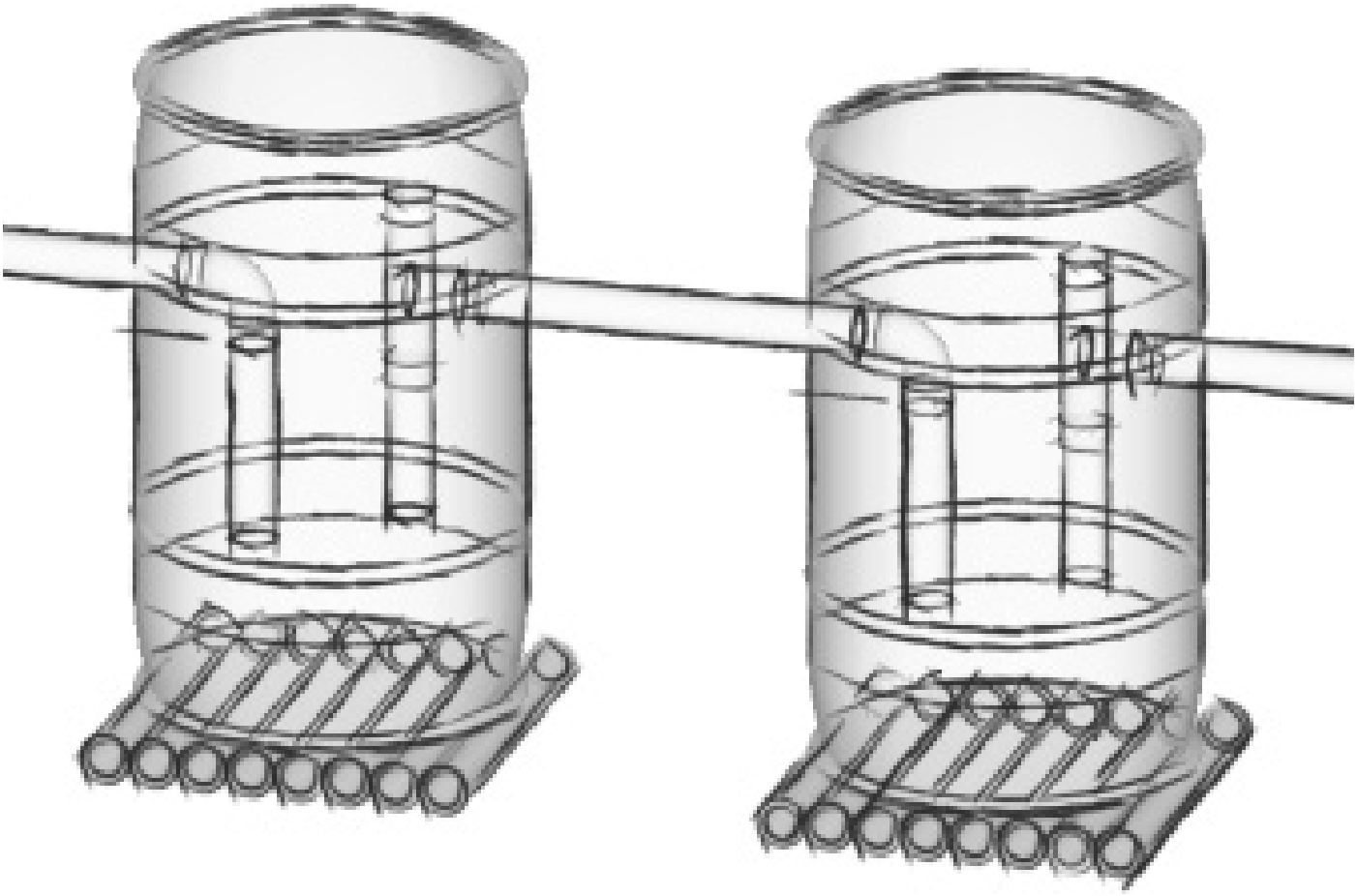
III. Plan how you will fit the components of the system into the space, keeping in mind that:

- The settling tanks each need 40cm x 40cm of space
- The biofilter(s) will need about 55cm x 55cm of space
- The storage tank will need about 45cm x 45cm of space

Limited space suggestions

- A more compact stacked or underground system could be implemented using a pump
- The vertical system arrangement is well suited to treat water from second floor sources
- Convert the space above the settling tanks into a table or drying rack

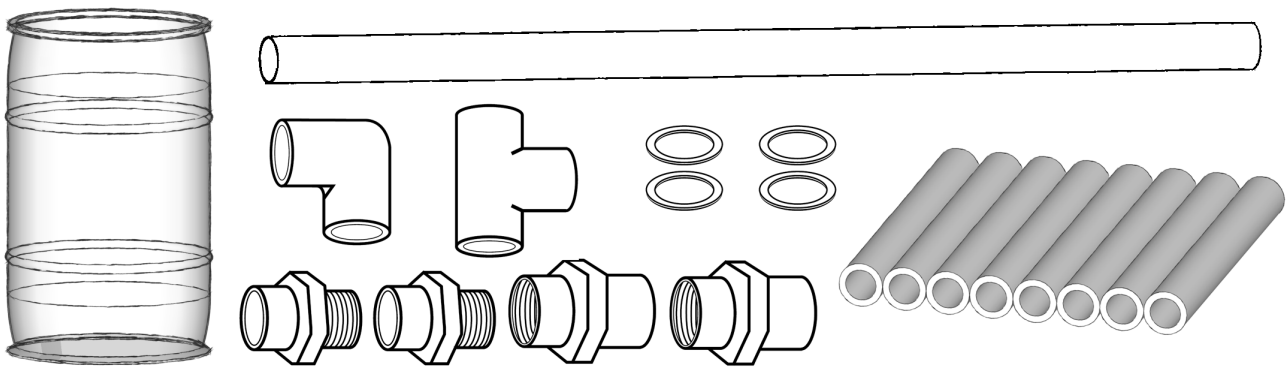
Settling tank construction



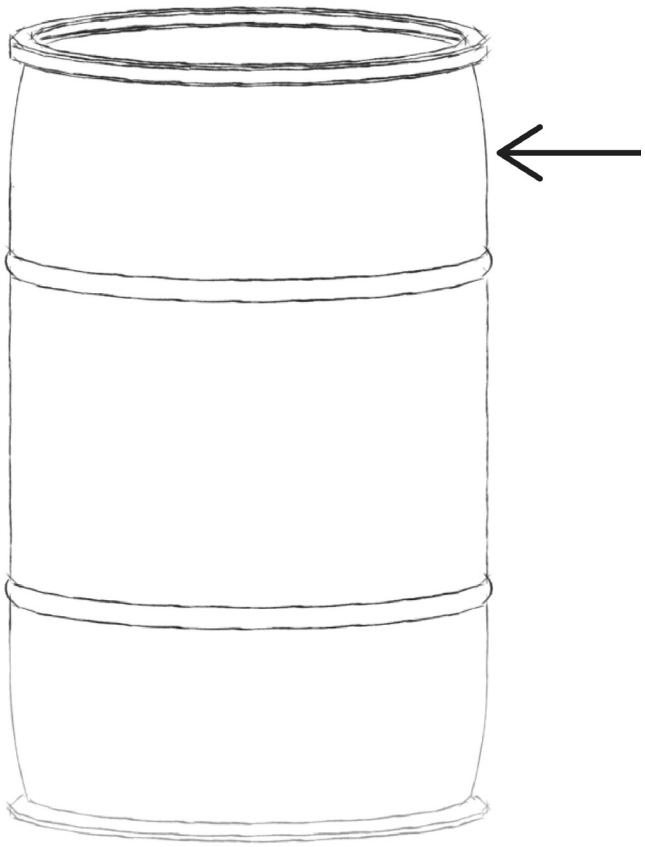
We suggest using two settling tanks to provide efficient settling of solids and grease collection. One-person households or households that don't cook often might be successful with one settling tank, and larger households or businesses such as restaurants might benefit from either additional settling tanks or larger settling tanks.

Parts needed FOR EACH TANK

- 1 50L barrel
- 1m straight PVC pipe
- 1 elbow connection
- 1 T-connection
- 2 inner threaded connections
- 2 outer threaded connections
- 4 gaskets
- support structure materials



Settling tank construction



Step 4

I. Identify where the water will enter the first settling tank.

II. This should be at a point where the side of the barrel is fairly flat , so that the pipes can easily connect to other parts of the system.

III. Mark the point with a pencil.

Step 5

I. If necessary, make a support structure to lift the settling tanks so that the inlet is about 3cm below the sink or other wastewater drain level.

II. If the sink or drain is fairly high, it is ok to keep the settling tank at a lower level.

Step 6

I. Drill holes in the settling tanks at the point identified in Step 4

II. The hole should be able to tightly fit the threaded connections, and should be approximately 40mm in diameter.

III. *If you do not have the right size drill bit, it is better to drill or cut a smaller hole and make it wider until it fits the pipe perfectly. A rounded file can be used to do this. The inner threaded connection should be used to check the size.*

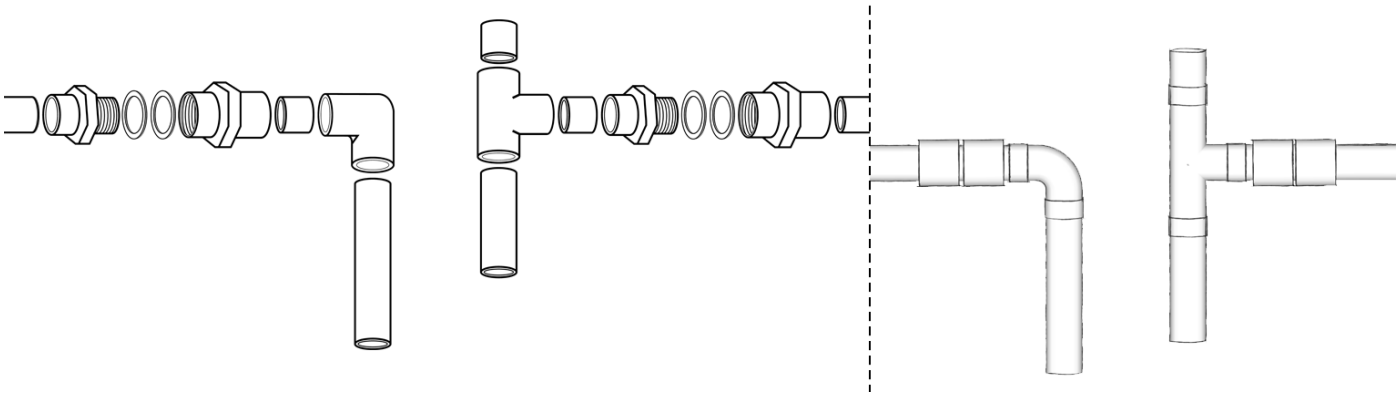
IV. Drill two holes in each settling tank.

V. If you are placing the tanks in a straight line, they should be on opposite sides of each tank at the same height.

VI. If you are arranging the tanks differently, drill the holes so that they will connect to each other.

VII. *Most plastic barrels have a seam that runs where the two halves were joined when it was made. You can use this as a guide to align holes that you need to drill on opposing sides.*

Settling tank construction



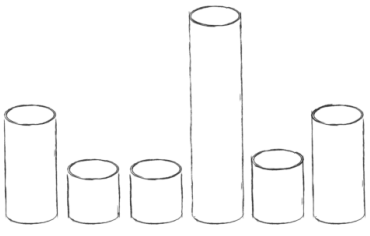
Step 7

I. Using a hacksaw, cut some pieces of straight pipe to connect to the various fittings of the settling tanks.

II. For each barrel you will need:

- 1 piece about 10cm long, to connect to the next tank
- 2 pieces about 4.5cm long, to connect fittings directly to the inlet and outlet
- 1 piece about 20cm long (measure this for your specific tank, the length should be the same as the height of the inlet hole you drilled, minus about 15cm. This piece directs the water that flows in to go to the bottom of the tank, but not so far that it stirs up the sediment)
- 1 piece about 10cm long, for the grease trap water intake
- 1 piece about 5.5cm long, for the grease trap air intake

III. After each cut, file or sand the edges of the pipe to get rid of small pieces of plastic and smooth the edges.



Step 8

I. Gather and lay out your pieces of pipe and fittings and do a dry fit: attach them to each other on a table to make sure that everything fits and nothing is missing.

II. The pipes should look as shown in the top figure for each settling tank.

III. Take the pieces of pipe apart and prepare to install them in the settling tank barrel.

Step 9

I. For each settling tank, wrap a layer of teflon tape around one of the inner threaded connection pieces.

II. Put a gasket around it, and screw it into the inlet of the settling tank.

III. Put another gasket around the other side, inside the barrel.

IV. Screw a female threaded connection piece onto the male piece, and tighten the two pieces together with one hand on each piece until the seal is tight between the gaskets and the sides of the barrel.

V. For the outlet of each settling tank, repeat the process but in the opposite direction, with the male threaded connection inserted outward from the inside to the outside of the barrel.

VI. *If the female and male pieces do not thread tightly, more layers of teflon tape can be added to make it tight.*

Step 10

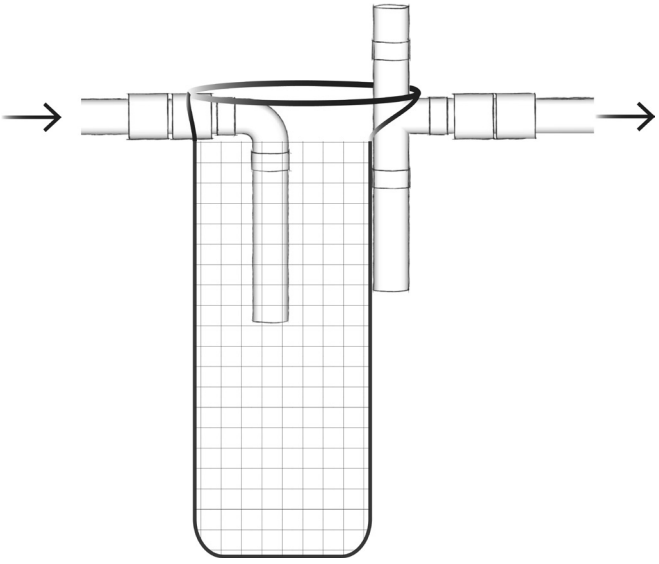
I. Connect the interior fittings together as shown above, applying about 2cm of glue to the outer surface of the end of each piece of straight pipe.

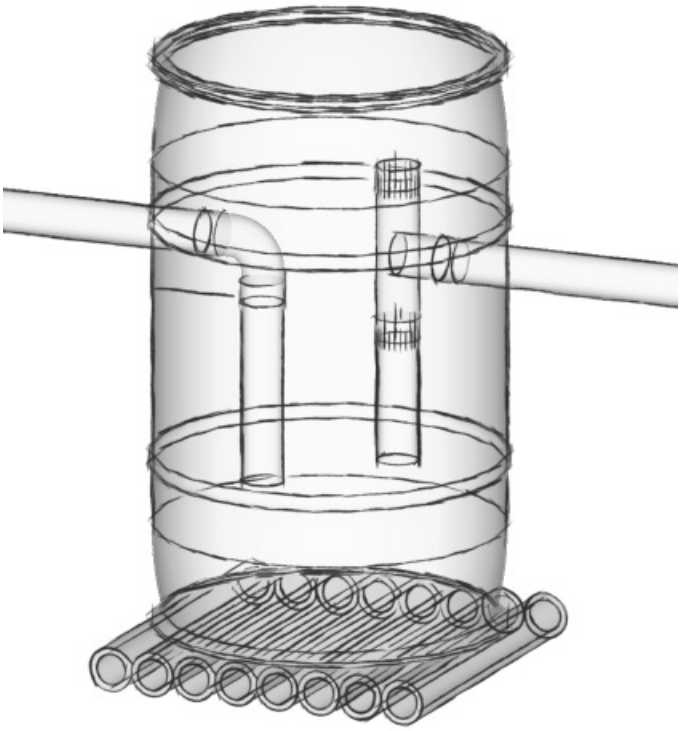
II. The exit should have a space for air to enter above the location of the holes, which is where the surface of the water will be and the grease and oil will collect.

III. The exit should have a space for air to enter above the location of the holes, which is where the surface of the water will be and the grease and oil will collect.

IV. The exit should also have a tube going down so that water leaving the tank will come from the middle layer and not include solids or oil and grease.

Settling tank construction





Step 11 (optional)

I. Cut a piece of plastic mesh that is 1m x 1m for each settling tank (or bigger to fit your settling tanks).

II. Fold the piece in half.

III. Fold the bottom edge (the short side) over twice about 2cm.

IV. Stitch together with string or plastic cable ties, one every 10cm.

V. Do the same for the long edge.

VI. Bend a piece of 1m plastic tubing into a circle, and attach to the top opening of the bag using string or plastic cable ties.

VII. Fit the completed bag into the settling tank, with the inlet tube directed into the middle of the bag, and the outlet tube outside of the bag.

VIII. *This will filter out larger solids, like food scraps that get into the system, so that they can be easily composted or discarded.*

IX. *A piece of mesh can also be secured across the opening at the top of the outlet with a hose clamp, so that food scraps and grease will not exit the settling tank. This is only necessary if the rate of inflow is high enough for the water in the settling tank to reach this level. If this happens often, the mesh will need to be cleaned periodically.*

Step 12

I. Drill one 8mm hole in the lid of each settling tank.

II. *This will permit gases to exit the tank.*

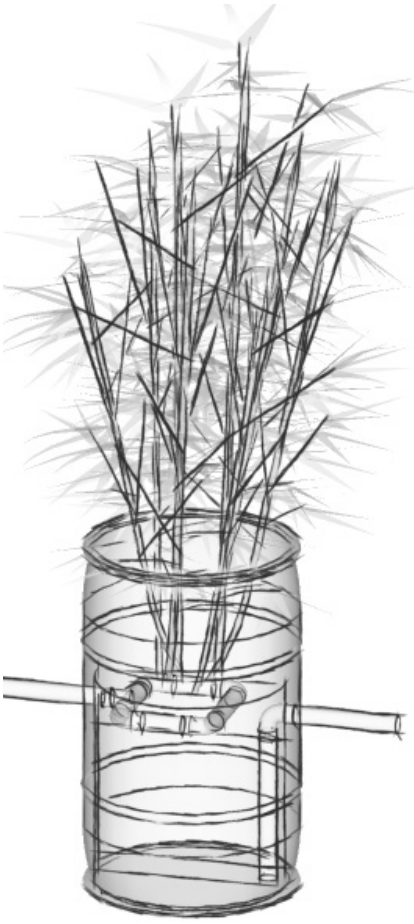
Step 13

I. Connect the tanks together using the remaining 10cm pieces you cut earlier.

II. Make sure that everything fits nicely, and that the tanks are level.

III. Once everything is lined up, glue the connecting pipes in place.

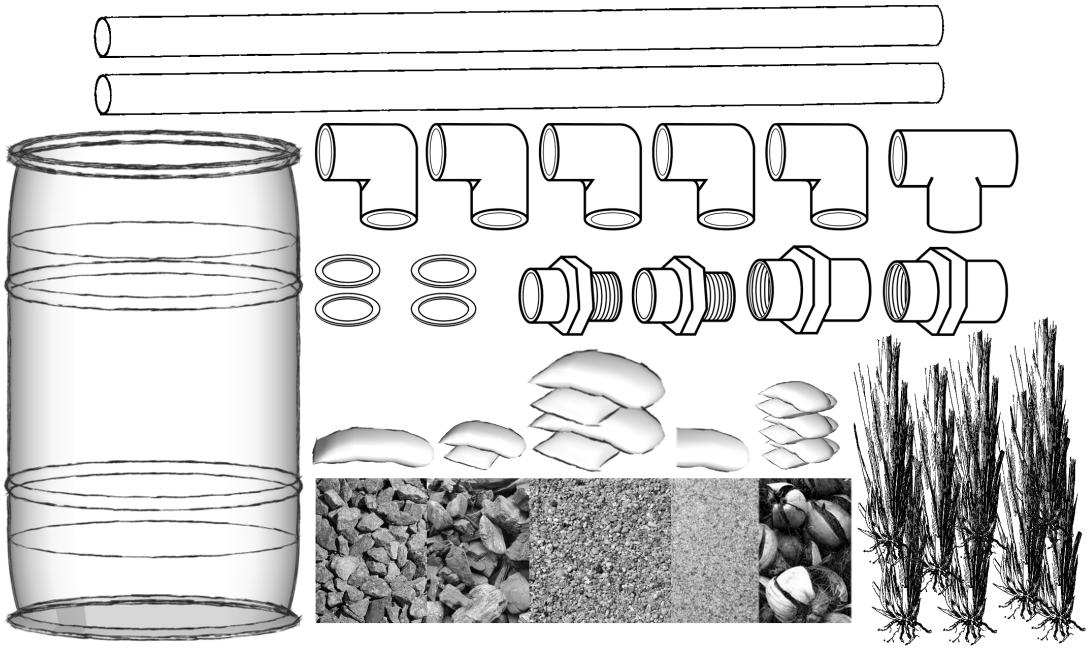
Biofilter construction



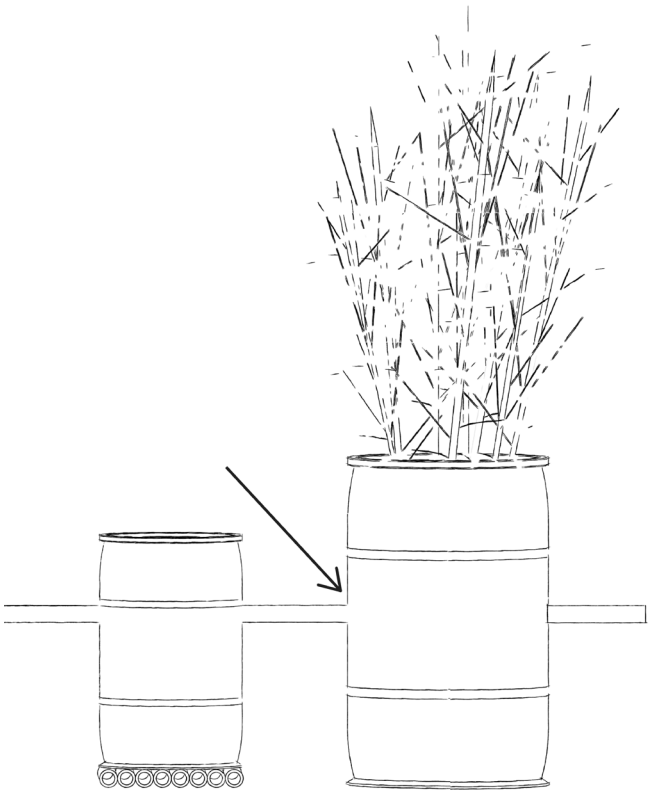
Parts needed FOR EACH BIOFILTER

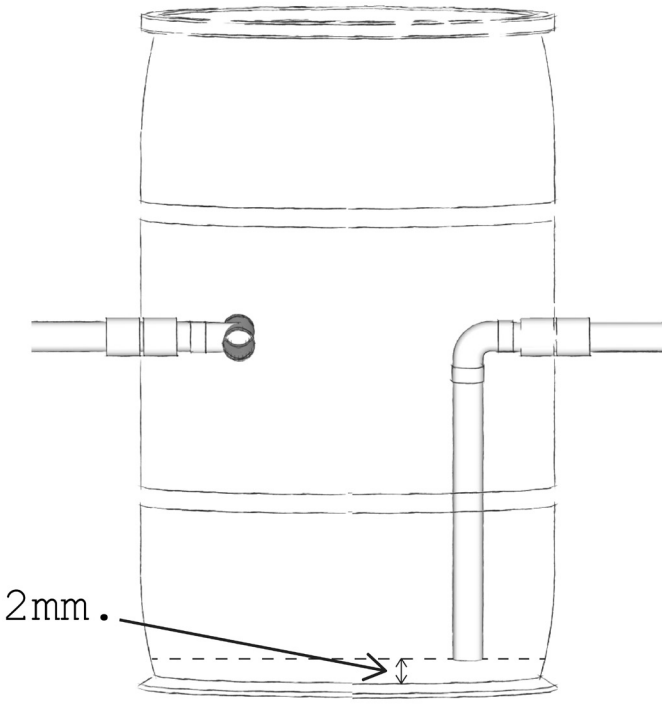
- 1 200L open-top barrel
- 2m straight pipe
- 5 elbow connections
- 1 T-connection
- 2 inner threaded connections
- 2 outer threaded connections
- 4 gaskets
- 1 bag coarse gravel
- 2-5 bags charcoal
- 4 bags coarse sand
- ½ bag fine sand
- 6-8 bags coconut fiber
- 8-10 vetiver plants

We suggest starting off with one biofilter and, if the treated water is still smelly or cloudy after one month, adding a second biofilter.



Biofilter construction





Step 14

I. Identify where the water will enter the biofilter.

II. This should be at the same level as the outlet of the last settling tank.

III. Measure the height and mark it on each side of the biofilter with a pencil.

Step 15

I. As you did with the settling tanks, drill two holes on opposite sides of the biofilter, at the points you marked earlier.

II. The hole should be able to tightly fit the threaded pipe connections, and should be approximately 40 mm in diameter.

III. *Remember it is better to drill a slightly smaller hole and to use a file to make it wider until it fits the pipe perfectly.*

IV. *IMPORTANT: make sure that all the inflow and outflow pipes are at the* ***same level****, and are the* ***same size****, so that the system does not overflow.*

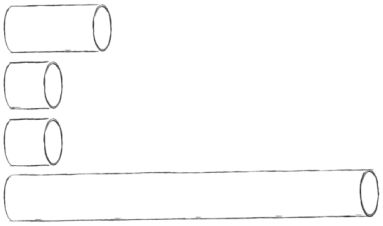
Step 16

I. Using a hacksaw, cut some pieces of straight pipe to connect the various fittings of the biofilter and to build a structure to gently distribute the entering water.

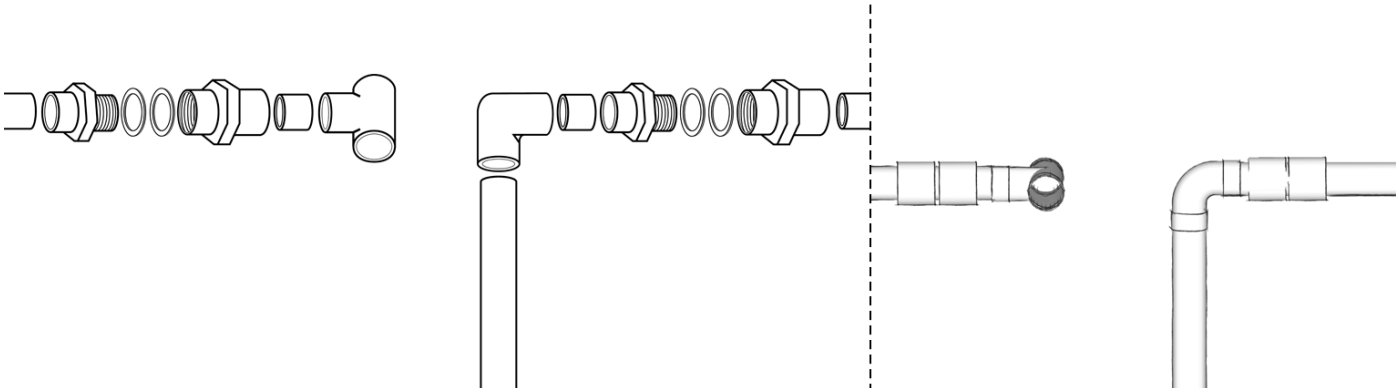
II. For each biofilter you will need:

- 1 piece about 10 cm long, to connect to the next tank
- 2 pieces about 4.5 cm long, to connect fittings directly to the inlet and outlet
- 1 piece about 40 cm long (measure this for your specific tank, the length should be the same as the height of the bottom of the inlet hole you drilled, minus about 5 cm. When connected, this piece will draw filtered water from about 2 cm above the bottom of the biofilter, in the drainage layer)

III. After each cut, file or sand the edges of the pipe to get rid of small pieces of plastic and smooth the edges.



Biofilter construction



Step 17

I. Gather and lay out your pieces of pipe and fittings and do a dry fit: attach them to each other on a table to make sure that everything fits and nothing is missing.

II. The pipes should look as shown in the above figure.

III. Take the pieces of pipe apart and prepare to install them in the biofilter barrel.

Step 18

I. As you did for the settling tanks, you will first connect the inlet and outlet fittings for the biofilter.

II. Wrap a layer of teflon tape around an inner threaded connection piece.

III. Put a gasket around it, and screw it into the inlet of the settling tank.

IV. Put another gasket around the other side, inside the barrel.

V. Screw an outer threaded connection piece onto the inner piece, and tighten the two together with one hand on each until the seal is tight between the gaskets and the sides of the barrel.

VI. For the outlet, repeat the process but in the opposite direction, with the inner threaded connection inserted outward from the inside to the outside of the barrel.

VII. *If the inner and outer pieces do not thread tightly, more layers of teflon tape can be added to make it tight.*

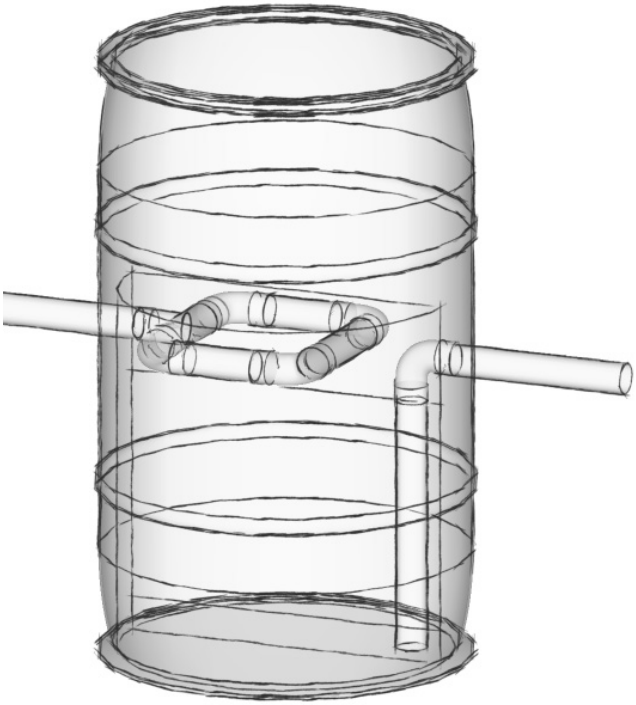
Step 19

I. Connect the interior fittings for the outlet as shown in the illustration, applying about 2cm of glue to the outer surface of the end of each piece of straight pipe.

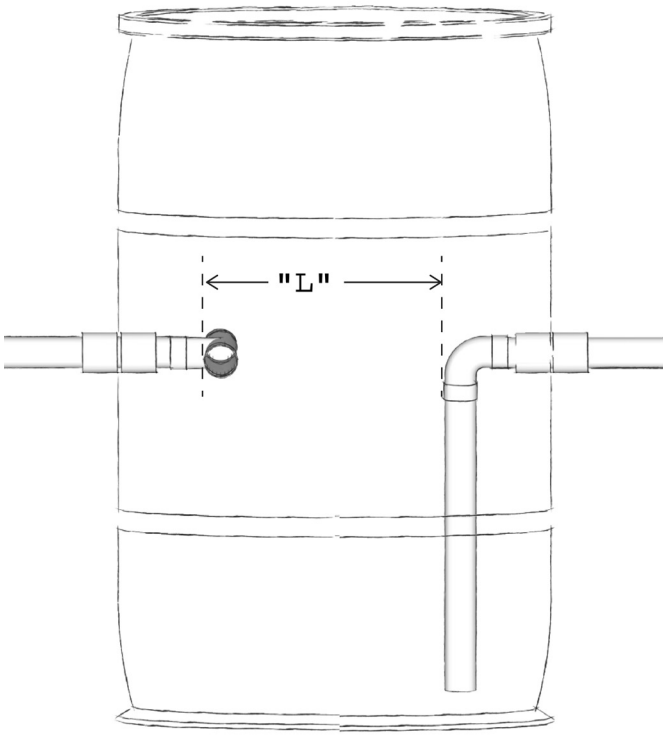
II. Make sure that there is 2cm of space from the bottom of the barrel to the pipe.

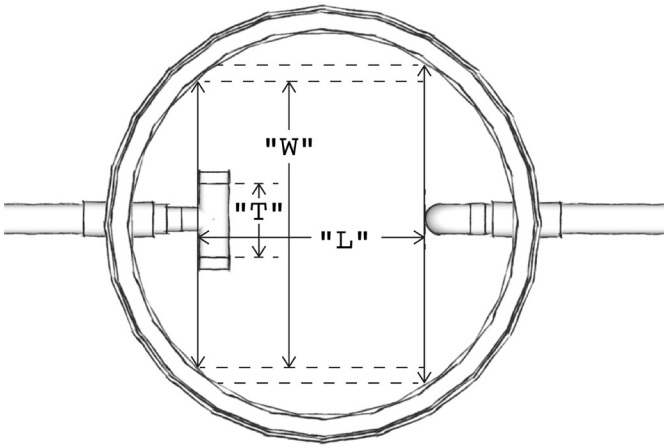
III. The outlet will draw water from near the bottom of the biofilter.

IV. The inlet will distribute water through a system of pipes, to be built and installed in the following sections.



Irrigation system construction





We made a square PVC pipe irrigation system. Flexible pipes can also be used but must be properly supported to distribute water evenly at the correct height. It is important that the irrigation system does not touch the sand, and that it gently and evenly distributes water into the biofilter.

Step 20

I. Measure the distance from the inlet fitting to the elbow at the outlet

II. Subtract about 5cm and write this number down.

III. This is the length. Call it “L”.

Step 21

I. Measure the distance across the barrel just before the elbow

II. Check that this distance is the same as that at the other side of the barrel, near the inlet.

III. If they are different, use the lower number.

IV. Subtract about 3cm and write this number down.

V. This is the width. Call it “W”.

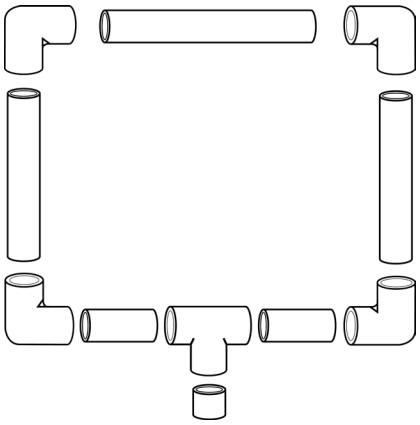
Step 22

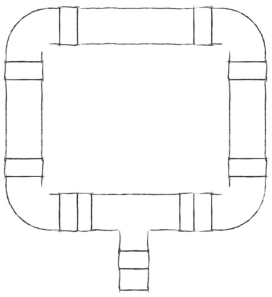
I. Measure the width that the T-connection will occupy in the width of the structure.

II. This will be the width across the top of the T-connection, minus two times the depth into which a pipe fits into each side (usually about 2cm).

III. Write this number down. Call it “T”.

Irrigation system construction





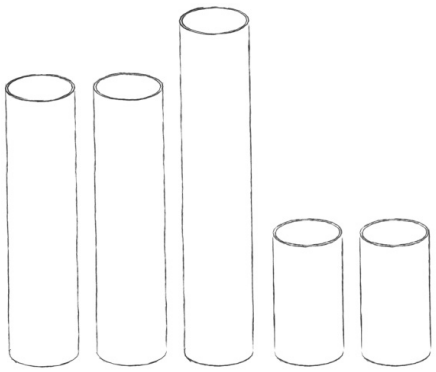
Step 23

I. Using a hacksaw, cut some pieces of straight pipe to build the irrigation system.

II. The lengths are calculated using the measurements in the previous steps, where D is the diameter of pipe that you are using (about 40mm), as follows:

- 2 pieces for the sides should be (L - (2×D))cm long (about 20cm for a 200L barrel). This is the length, minus the space for two elbows at the corners.
- 1 piece for the long edge should be (W - 8)cm long (about 25cm for a 200L barrel). This is the width, minus the space for two elbows.
- 2 pieces for either side of the T-connection should be ((W - T - (2×D))÷2)cm long (about 9cm). This is the width, minus the size of the T-connection, minus the space for elbows, and divided into two pieces.

III. After each cut, file or sand the edges of the pipe to get rid of small pieces of plastic and smooth the edges.



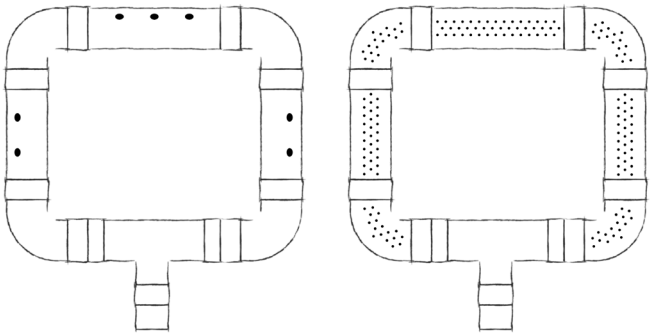
Step 24

I. Assemble the water distribution system as shown, without using glue.

II. Push the connections together firmly for a tight fit.

III. If the pipes do not make a nice rectangle, cut any that are too long until it fits together.

IV. Make sure that the rectangle fits into the biofilter, between the inlet and outlet, with the T-connection facing the inlet. If it is too big, cut the pieces shorter so that it fits.



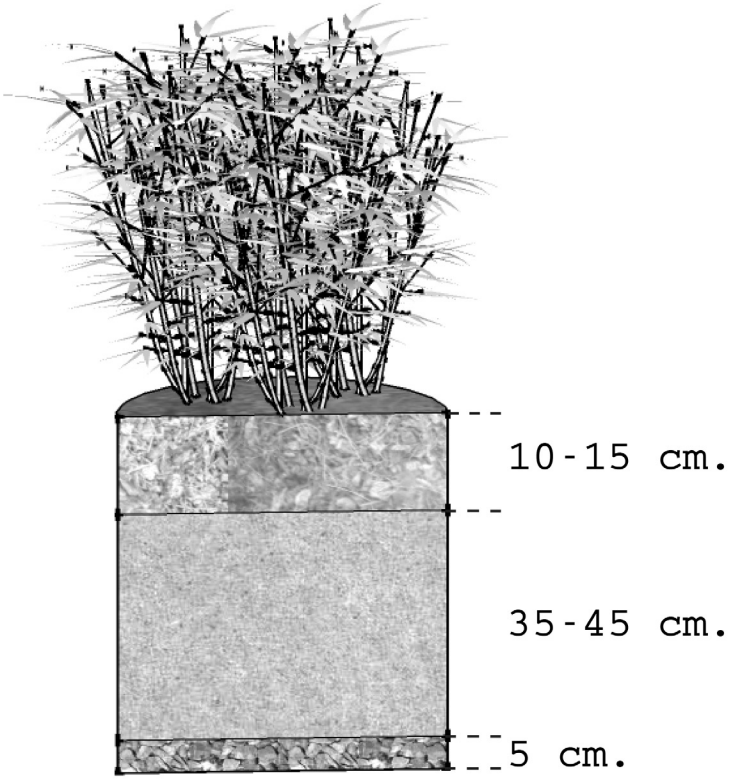
Step 25

I. Drill about 180 drainage holes of 3mm diameter spaced 30mm apart in the bottom of the irrigation system in 3 or 4 rows.

II. Drill 5 - 10 overflow holes of 8 mm diameter, spaced evenly around the top of the irrigation system, to allow water to escape at high flow volume.

III. Do not install the irrigation system yet, it will be added in the next section.

Filling the biofilter



Before you fill the biofilter with gravel and sand, be sure that it is in the right location. Once you fill it, the biofilter will be extremely heavy and difficult to move.

Step 26

I. Clean the rocks and gravel by rinsing in a bucket using clear water, until you can see the rocks through the water.

II. DO NOT USE SOAP!

III. You can separate bigger rocks from smaller rocks, and layer them in the biofilter from largest to smallest to create a more even flow.

Step 27

I. Make sure the your sand is clean enough.

II. Add a handful of sand to a clear water bottle, fill it with water, and shake for 10 seconds.

III. After 4 seconds, if you can see the surface of the sand from the side, and the water is not clear, it is clean enough.

IV. If you cannot see the surface, it should be rinsed as you did with the rocks and gravel.

V. *Be careful not to rinse it too much!*

Step 28

I. Using tap water, thoroughly rinse out the tank to remove any residue or plastic shavings.

II. To begin layering the biofilter, add 10cm of clean water to the bottom of the empty barrel.

III. Pour in 5cm of rocks and gravel, starting with the biggest ones and ending with the smallest.

IV. Spread each layer evenly across the entire bottom.

Step 29

I. Add clean water up to 5cm below the outlet.

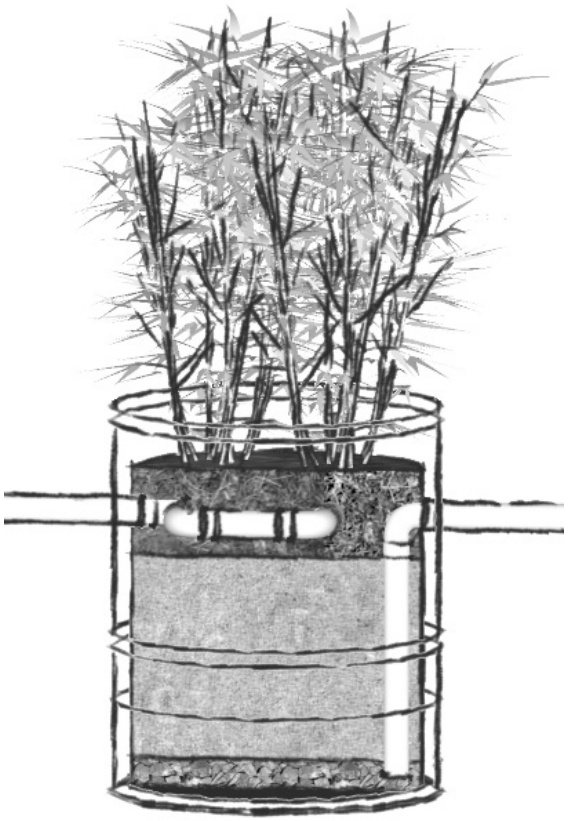
II. Pour in bags of coarse sand until it reaches a level 5cm below the outlet, using a plank to level it.

III. Ideally the layer of sand should be at least 45cm, if it is less it will be less effective.

IV. *If you want, you can use fine sand for the top 5cm of sand to decrease the flow rate.*

V. *You can also use a mixture of sand and carbon in the bottom 5cm of sand to improve capture of odors and chemicals.*

Filling the biofilter



Step 30

I. Connect the irrigation system to the inlet with the small holes facing down and make sure it is supported 5cm above the sand layer.

II. Make sure that no part of it touches the sand!

Step 31

I. Add coconut fiber strips to cover the entire surface of sand up to the top of the irrigation system.

II. Alternatively, you can also use rice husks, pearlite, or fireclay, all available at gardening stores. Rice husks and coconut fiber are more likely to be available from re-used sources as they are common agricultural waste products.

III. Cover up to 3cm over the irrigation system with coconut fiber.

IV. Add smaller pieces of coconut fiber to the top layer to keep mosquitoes out of the water.

V. *NOTE: coconut fiber can initially give the water a reddish color.*

VI. *TIP: you can add a layer of EM (effective microorganisms), to the top of the sand in order to jumpstart the bacterial growth.*

Planting the biofilter

We used vetiver grass for the biofilter, but other plants can also be used. Plants that grow in local wetlands are good choices. It is better not to use edible plants. Depending on your waste water, the plants can filter out chemicals, nutrients, and some metals.

A plant lookup tool for the US can be found here: http://www.conteches.com/products/biofilter-plant-lookup.aspx

Step 32

I. Rinse the soil off the roots of the plants.

II. Place them in the coconut fiber evenly spaced around the tank.

III. Do not put the plants directly above the irrigation system, as it can lead to clogging.

IV. Make sure the plants are held securely in place with the coconut fiber.

V. You do not have to bury the roots very deep, the plants will do that themselves.

Connecting everything

Step 33

I. Once you have everything built, connect the tanks in sequence.

II. It is best to start from the biofilter and work backwards, as the biofilter is heavy and will not easily move.

III. Use one 10cm pipe as a link between each pair of tanks.

IV. *Gluing these pieces in place is optional. If you decide to glue it, it will be more difficult to remove or insert components into the system in the future. If you decide not to glue it, you must be sure to push the pipe on firmly for a tight fit. If you notice any leaks, you will need to either push the pipe on tighter, or add some glue.*

V. Put about 1cm of glue around one end of the first pipe (if you are gluing) and insert it into the biofilter.

VI. Put glue on the other end of the same pipe (if you are gluing) and attach the outlet end of the second settling tank.

VII. Be sure to firmly press the connection together.

VIII. Repeat the connection steps for the first settling tank.

IX. Be sure to attach the settling tanks in the right orientation, with the inlet side having the downward elbow, and the outlet side having the T-connection.

Step 34

I. If you have a sink or other existing wastewater pipe, you will need to connect it to the system now.

II. Using a flexible hose or series of PVC pipes and fittings, you will need to align the outlet with the entrance of the system.

III. With a hose clamp (for flexible pipe) or glue (for PVC), attach the outlet from the sink to the system.

IV. If necessary, use an appropriate adapter.

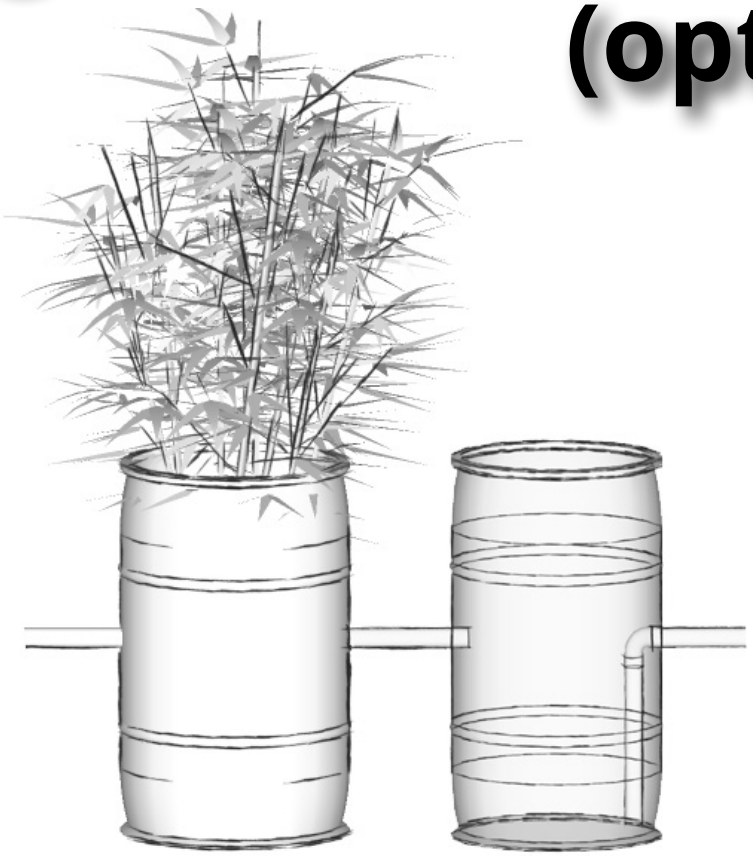
Step 35

I. Turn on the water!

CONGRATULATIONS!

You have built a system that will treat your household wastewater!

Storage tank construction (optional)



Step 36

I. Identify where the water will enter the storage tank.

II. This should be at the same level as the outlet of the biofilter

III. Measure the height and mark it on each side of the storage tank with a pencil.

Step 37

I. As you did with the other barrels, drill two holes on opposite sides of the storage tank, at the points you marked earlier.

II. The hole should be able to tightly fit the threaded pipe connections, and should be approximately 40mm in diameter.

III. *Remember it is better to drill a slightly smaller hole and to use a file to make it wider until it fits the pipe perfectly.*

IV. *IMPORTANT: make sure that all the inflow and outflow pipes are at the **same level**, and are the **same size**, so that the system does not overflow.*

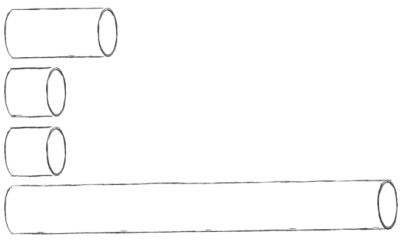
Step 38

I. Using a hacksaw, cut some pieces of straight pipe to connect the various fittings of the biofilter and to build a structure to gently distribute the entering water.

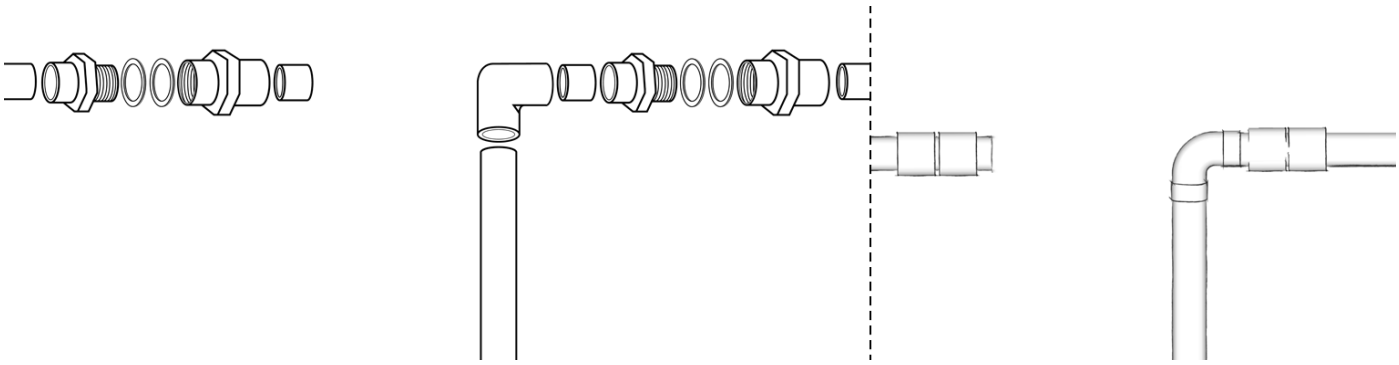
II. For the tank, you will need:

- 1 piece about 10 cm long, to connect to the drainage pipe
- 2 pieces about 4.5 cm long, to connect to the inlet and outlet
- 1 piece about 40 cm long (measure this for your specific tank, the length should be the same as the height of the bottom of the inlet hole you drilled, minus about 10 cm. When connected, this piece will drain water from near the bottom of the tank when it fills).

III. After each cut, file or sand the edges of the pipe to get rid of small pieces of plastic and smooth the edges.



Storage tank construction (optional)



Step 39

I. Gather and lay out your pieces of pipe and fittings and do a dry fit: attach them to each other on a table to make sure that everything fits and nothing is missing.

II. The pipes should connect as shown above.

III. Take the pieces of pipe apart and prepare to install them in the storage tank barrel.

Step 40

I. As you did for the other barrels, you will first connect the inlet and outlet fittings for the storage tank.

II. Wrap a layer of teflon tape around an inner threaded connection piece.

III. Put a gasket around it, and screw it into the inlet of the settling tank.

IV. Put another gasket around the other side, inside the barrel.

V. Screw an outer threaded connection piece onto the inner piece, and tighten the two together with one hand on each until the seal is tight between the gaskets and the sides of the barrel.

VI. For the outlet, repeat the process but in the opposite direction, with the inner threaded connection inserted outward from the inside to the outside of the barrel.

VII. *If the inner and outer pieces do not thread tightly, more layers of teflon tape can be added to make it tight.*

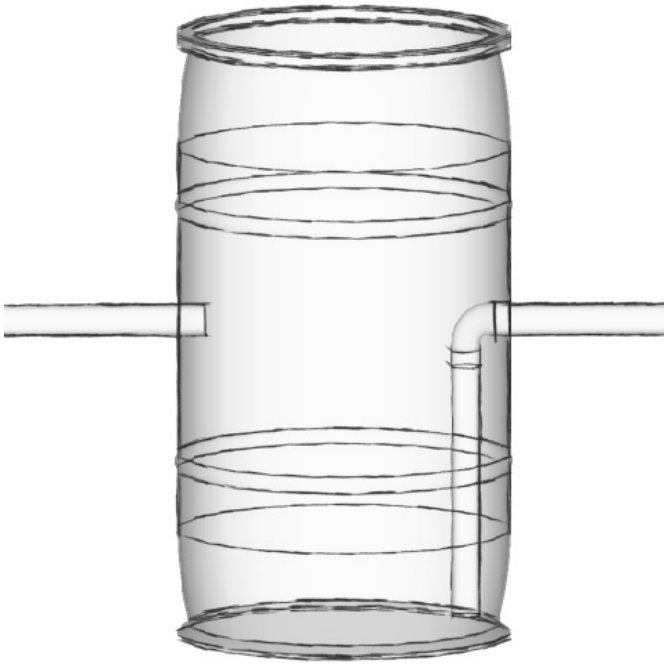
Step 41

I. Connect the interior fittings for the outlet as shown, applying about 2cm of glue to the edge of each piece of straight pipe.

Step 42

I. Connect the inlet of the storage tank to the outlet of the biofilter using the 10cm pipe you cut earlier.

II. Connect the outlet of the storage tank to the drainage pipe, using appropriate pipe fittings and adapters.



User manual

Initial use

- It will take about a month before the system is fully up and running, during this time you can connect the outflow to your previous drainage system.
- During the first weeks, some of the sand and coconut husk might flush out of the system, so the water might appear red or dirty.
- After two weeks to a month, a healthy layer of bacteria will form in the biofilter. This will remove chemicals and bad bacteria from your water. After this, the water can be used for washing, irrigation, or putting into the environment.

Cleaning and maintenance

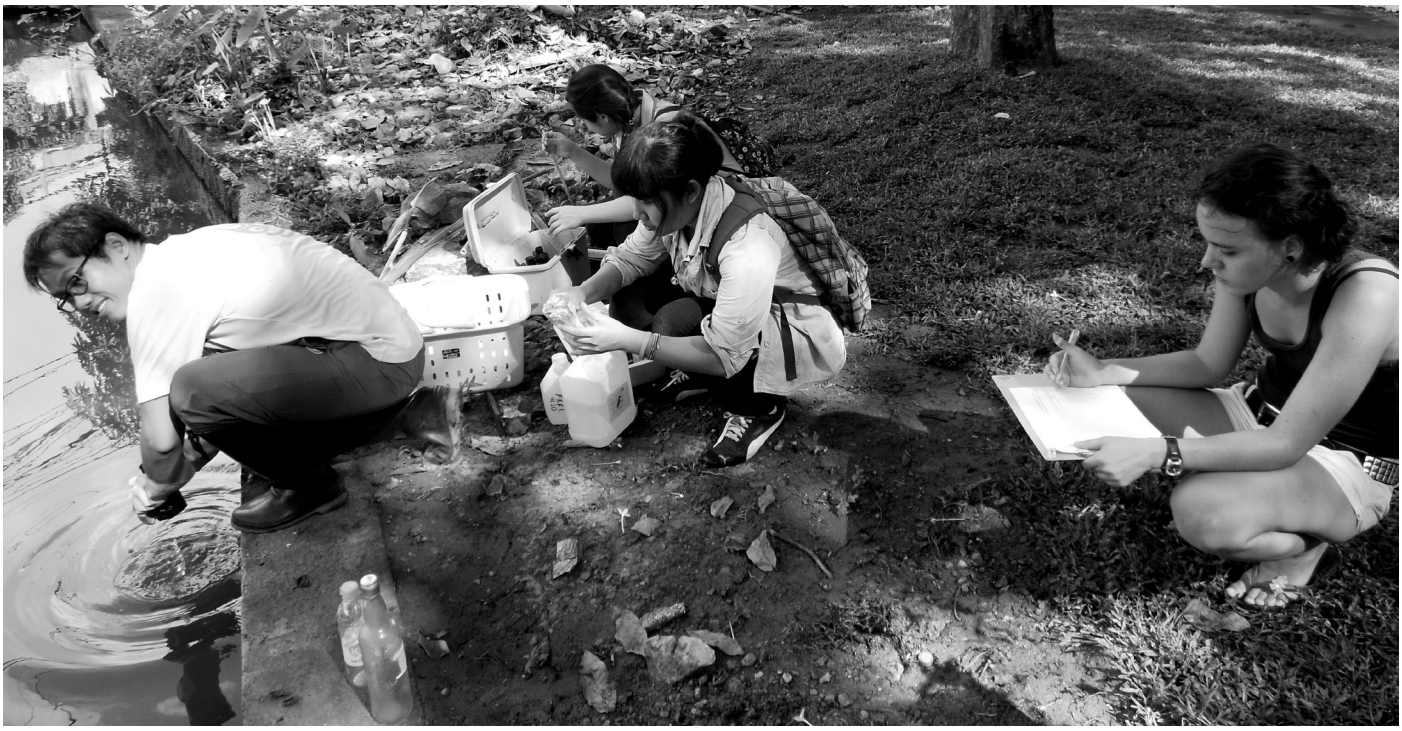
SETTLING TANKS

- Oil should be cleaned out of the settling tanks once a month for households and twice a month for restaurants. This can be done using rubber gloves and a plastic cup or spoon to scrape off the top layer of oil. It can then be put into a glass jar or bottle for storage.
- TIP: The oil can be used to make soap or alternatively sold to grease collectors.
- Floating food bits can be scooped out and put through a strainer, with the collected solids put into the trash or compost, and the water put back into the settling tank.
- The solids at the bottom of the settling tank should be cleaned out every 1-3 months, depending on how much it is used and how many solids build up. A stick can be inserted into the tank to check how much solids are at the bottom.
- Using rubber gloves, scoop out the water in the tank with a bucket and place it in anoth er bucket or tank. The solids can then be taken off the bottom with a garden shovel or similar. After cleaning it the water can be poured back into the system.
- These solids can be thrown away, dried in the sun to make fertilizer, or composted.
- WARNING: it stinks!

BIOFILTER

- The vetiver grass needs to be cut every month. If it grows a lot this is an indication of high nutrient loads, and should be cut more often.
- TIP: the leaves of vetiver grass can be used to make woven products.

User manual



Monitoring

- Make sure the outgoing water is clear, and doesn't have solids, oil or grease in it.
- If there are solids (after 1 month) you should add an additional or larger settling tank.
- Make sure the water smells normal. If it smells unpleasant you can add charcoal into the collection tank. If it still smells bad after two days, you should add another bio-filter to the system.
- You can get test strips for pH, nitrate (NO_3^-), nitrite (NO_2^-), alkalinity, and hardness at scientific supply stores, or online at: http://www.legaeng.com/WaterQuality.
- High hardness is bad for the plants, but decreases the dissolved metals in water environment.
- High nitrate and nitrite levels are bad for environmental water but good for plants and gardening.
- High nutrients won't have negative effects for the irrigational or cleaning use. Ammonia in particular is a strong cleaning agent, and nitrogens and phosphates are powerful fertilizers.
- High nutrient levels can have negative impacts on environmental water quality of the canal.
- If water is discharged into the canal, plants can be added to the biofilter or aquaponic plants directly in collection tank to decrease the nutrient load.
- Low pH levels (< 6) are bad for both plants and the environment. High pH levels (> 8) are generally not a problem for plants, but increase the toxicity of ammonia (NH_3) for fish.

pH level	
3.3 - 4.7	optimal for mosquito larvae
4 - 10	limits for the most resistant fish species; fish eggs can hatch, but deformed young are often produced; this range is tolerated by trout
4 - 9	tolerable range for most fish
7.5 - 8.4	optimal for algae

- High alkalinity will help to stabilize the pH. Low alkalinity means the water will be sensi tive to factors affecting pH, particularly acid rain.
- Contact your local government or university to have the water tested if you suspect heavy metals in your water. Alternatively, heavy metal test kits can be bought online at: http://kyoritsu-lab.co.jp/english/seihin/list/packtest/index.html.

Datasheet

Date cleaned	pH	Alkalinity	Hardness	Nitrate (NO_3^-)	Nitrite (NO_2^-)	Dissolved oxygen (DO)	smell	flow	turbidity	comments
8 June 2014	*8.5*	*720*	*300*	*0*	*0*	*1.5*	*odorless*	*low*	*clear*	*biofilter rebuilt on June 6th*

Contact

info@thailab.org
www.thailab.org

facebook.com/ChiangmaiThailab
twitter.com/ThailabCNX